Date: March 27, 2000 (Rev. # 2) SOP No. ISSI-VBI70-02

Title: RESIDENTIAL SOIL SAMPLING FOR YARDS, AND SCHOOL OR PARK SOILS

APPROVALS:

Author ISSI Consulting Group, Inc. Original Date: June 14, 1999

SYNOPSIS: A standardized method for exposure-based residential yard, school or park surface soil sampling is described. Protocols for sample collection, compositing, and handling are provided.

Received by QA Unit:

REVIEWS:

TEAM MEMBER	SIGNATURE/TITLE	DATE
EPA Region 8	[signature] / RPM	3/27/00
ISSI Consulting Group, Inc.	[signature] / FQAC	3.27.00

Revision Date	Reason for Revision
July 29, 1999	Modified the definition of "sampleable" areas to include regions where temporary obstructions are present. This will assure that both current and future land use is evaluated.
March 27, 2000	Refined Sections 5 and 6 slightly to better represent field activities.

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to provide a standardized method for residential yard, school, or park surface soil sampling, to be used by employees of USEPA Region 8, or contractors and subcontractors supporting USEPA Region 8 projects and tasks. This SOP describes the equipment and operations used for sampling residential yards, and school or park surface soils in areas which will produce data that can be used to support risk evaluations. Deviations from the procedures outlined in this document must be approved by the USEPA Region 8 Remedial Project Manager or Regional Toxicologist prior to initiation of the sampling activity.

2.0 RESPONSIBILITIES

The Field Project Leader (FPL) may be an USEPA employee or contractor who is responsible for overseeing the residential surface soil sampling activities. The FPL is also responsible for checking all work performed and verifying that the work satisfies the specific tasks outlined by this SOP and the Project Plan. It is the responsibility of the FPL to communicate with the Field Personnel regarding specific collection objectives and anticipated situations that require any deviation from the Project Plan. It is also the responsibility of the FPL to communicate the need for any deviations from the Project Plan with the appropriate USEPA Region 8 personnel (Remedial Project Manager or Regional Toxicologist).

Field personnel performing residential yard, and school or park soil sampling are responsible for adhering to the applicable tasks outlined in this procedure while collecting samples. The field personnel should have limited discretion with regard to collection procedures, but should exercise judgment regarding the exact location of the Sample Point, within the boundaries outlined by the FPL.

3.0 EQUIPMENT

- Soil augers - Various models of soil augers are acceptable and selection of the specific brand and make of tool will be recommended by the contractor implementing the field work (Morrison Knudsen Corporation). Augers are usually made of stainless steel, and should be capable of retrieving a cylindrical plug of soil 2 inches in diameter and 2 inches long. In all cases the procedures recommended by the manufacturers should be followed with regard to use of the auger. Augers with disposable plastic sleeves may be employed to minimize the decontamination

effort.

- Collection containers - plastic zip-lock bags.
- Trowels - for extruding the soil from the auger. May be plastic or stainless steel.
- Compositing Bowl - for collecting the grab samples for compositing. Samples will be coarsely mixed in this bowl. May be plastic or stainless steel.
- Gloves - for personal protection and to prevent cross-contamination of samples. May be plastic or latex. Disposable, powderless.
- Field clothing and Personal Protective Equipment - as specified in the Health and Safety Plan.
- Sampling flags - three different colors or numbers (e.g., red, blue, and yellow). Used for identifying yard soil sampling locations. Each color or number represents a different composite sample.
- Wipes - disposable, paper or baby wipes. Used to clean and decontaminate marker flags.
- Field notebook -a bound book used to record progress of sampling effort and record any problems and field observations during sampling.
- Three-ring binder book- to store necessary forms used to record and track samples collected at the VBI70 site. Binders will contain the Surface Soil Data Sheet, Site Diagram, and sample labels for each day. Example forms are provided in Attachment 1.
- Permanent marking pen - used as needed during sampling and for documentation of field logbooks and data sheets.
- Measuring tape or wheel - used to measure each property.
- Measuring tape or pocket ruler - used to measure the length of soil core in the soil coring device.

- Trash Bag - used to dispose of gloves and wipes.

4.0 SAMPLING PATTERN

Sampling patterns for residential yard, school or park soils are designed to identify and collect samples to support human health risk assessment. Idealized sampling patterns for residential soils are presented in the attached figures, but possible deviations from these sampling patterns could occur based on buildings or other obstructions found at each property. However, sample locations will be identified on a property-by-property basis. Proposed sampling patterns for the individual schools and parks will be provided as an attachment to the Phase III Field Investigation Project Plan at a later date.

4.1 RESIDENTIAL YARD SOIL

Residential yard soil samples will be composited, which requires soil collection from multiple (sub-sample) points. These soils are then mixed and used as a measure of the concentration averaged over the entire area (property). Surficial yard soil samples (0-2 inch depth) will be collected.

Soil Sample Location Identification

The surficial sampling locations within a yard will be based on a 30-point sampling grid. Because of the large number of properties that require sampling during this project, an independent chemical analysis will not be performed for each of the sub-samples collected from each property. Rather, three composite samples will be collected per residence, each consisting of 10 sub-samples that are identified by marker flags of the same color or number. Although numbers may be used for identification of sample locations, for the purposes of this SOP, all procedural descriptions will be illustrated using colored marker flags (e.g., 10 red, 10 blue, and 10 yellow). The number of total sample points may be reduced from 30 to 15 (three 5-point composites) at properties with very limited sample area, for example, the sample points would result in points being less than five feet apart (total sample area is less than 750 square feet). Identification of individual grab sample locations will be performed using the following general steps.

The team leader (TL) for each sampling team will be trained in this procedure in order to ensure replicable sample location assignment. The following steps will be followed (in order) prior to any sample collection:

a. Measure each yard

b. Pace off each building or permanent obstruction

c. Identify major sampleable areas

d. Determine the number of sample points in each subarea

e. Record sample locations

f. Mark sample locations

g. Collect the sample

4.1.1 Measure each yard

The TL will visit a residence at the time of sampling to assign the sampling scheme. The TL will measure the property dimensions with a measuring tape, measuring wheel or laser measuring device (± 0.5 feet). Draw a sketch of the property and record property dimensions, north orientation, and adjacent streets and alleyways on the site diagram.

4.1.2 Pace off each building or permanent obstruction

The TL will then pace off the major permanent structures of the residence (e.g., dimensions of the property boundary, house, garage, driveway, etc.) and prepare a site diagram to approximate scale (± 3 feet on each measurement). The goal is not have a drawing to scale, but instead to have an estimate of the total sampleable area in the residential yard. The total sampleable area is defined as any area on the property that is free of permanent obstructions. Temporary obstructions such as automobiles or trailers parked on unpaved property locations, picnic tables, plastic or other materials covering the property are not permanent structures and will be considered "sampleable". Therefore, areas that could be used in the future if the temporary obstructions were removed, should be identified on the field diagram and must be considered in sample location identification. Figure 2 and Figure 3 provide examples of a typical residence at the VBI70 site that has been drawn on a grid.

4.1.3 Identify major sampleable areas

For each residence, the sampleable area will be divided into rectangular subareas, using natural boundaries such as the house, garage, sidewalk or gardens as division markers (See Figure 3). A minimum of three and a maximum of eight subareas will be identified to the nearest pace (± 3 ft). For convenience, it is recommended that the number of subareas identified is minimized. Draw the

subareas on the site diagram sheet. Count the number of squares in each subarea and record this information on the field data sheet.

4.1.4 Determine the number of sample points in each subarea

Add the total number of squares contained in each of the subareas, and record in the appropriate space on the surface soil data sheet. Divide this number by 30 to determine the grid area per sample point, and record in the appropriate space on the data sheet (Attachment 1). To determine the number of sample points in each subarea, divide the number of squares in each subarea by the grid area per sample point. Using standard analytical rounding procedures, round each number to the nearest whole number to determine the number of sample points in each subarea. (See Figure 3 for example). The number of total sample points may be reduced from 30 to 15 (three 5-point composites) at properties with very limited sample area, for example, the sample points would result in points being less than five feet apart (total sample area is less than 750 square feet).

4.1.5 Record sample locations

Before placing flags into the yard, mark their planned location on the site diagram. Marking flag locations on the site diagram before actually placing them will give the TL a chance to check that sample locations are evenly distributed within each subarea, and that all sub-sample locations are documented and recorded. In addition, if an error has occurred in the calculation of sub-sample locations, it will be discovered before any flags have been staked. Because property sizes and obstacles present at each residence may vary significantly, actual sample locations will be identified using a diagram that will be drawn for each individual property sampled. If either permanent or temporary obstructions are present at the intended sampling locations (e.g., sidewalk, shed, garden, etc.), the sample point should be offset so that a surficial yard soil may be collected, then the actual sample location must be correctly documented on the field diagram. If the TL identifies an error in the sample location identification procedures that compromise the readability of the document, a new, revised diagram may be necessary. After recording all of the sample points, the TL should check the site diagram to make sure that sub-sample locations are not clustered in any area (unless clustering is a result of offsetting sample locations due to obstructions). The TL should also verify that sample points are approximately equidistant throughout the property.

4.1.6 Mark sample locations

Starting at one corner of the property, stake sub-sample locations using a repeated sequence of three distinct flag types (i.e., Yellow, Blue, Red, Yellow, Blue, Red, etc.) in alternating sequence across subareas. Do not place the same flag types next to each other, so that there is an even distribution of flags in each subarea (Figure 3). As seen in Figure 3, the location of each marker

flag should be approximately equidistant from the other flags within each subsection. Additionally, each color flag should be alternately placed so that the same color marker flags are not clustered. A sample location or flag may be reassigned if clustering is observed.

4.1.7 Surface Soil Collection

The first composite will be collected by combining the samples at flags of similar color (e.g., red). Grab samples will be collected from the 0-2 inch soil horizon adjacent to each marker flag. Each sample will be collected using a clean coring tool (2-inch diameter). Each grab sample marked by a red flag will be placed into a single zip-lock bag and labeled in accord with the most recent version of the Sample Identification and Tracking SOP (# ISSI-VBI70-01). The second and third composite samples will be collected in identical fashion but by sampling next to the blue and yellow flags, respectively.

4.2 SCHOOLS AND PARKS SOIL

Surface soil samples at schools and parks will be collected using the same sampling strategy as discussed for the residential soil sampling (Section 4.1). The number of grab samples collected at an individual school or park may vary, but 3 composite samples will be collected at minimum. Each individual grab sample will be identified using marker flags of any three different colors (e.g., red, blue and yellow). The exact sampling pattern will be unique to the individual school or park and will be submitted as an attachment to the Project Plan at a later date. At minimum, each marker flag will be approximately equidistant from the other flags and each color flag should be alternately placed so that the same color marker flags are not clustered.

Decontaminate equipment as described in Section 9.0

5.0 COLLECTION OF COMPOSITE SAMPLES USING A CORING TOOL

A new pair of plastic gloves are to be worn in each Sampling Zone.

Locate the Sub-sample Point as specified by the TL and clean the area free of twigs, leaves, and other vegetative material that can be easily be removed by hand. If the specified sub-sample point is occupied by a rock, cobble or other hard object of sufficient size to be incapable of easy removal by hand, move the sub-sample point to a location closest to the original point.

Place the soil coring tool on the ground and position it vertically. Holding the tool handle with both hands, apply pressure sufficient to drive the tool approximately 2 inches into the ground while applying a slight twisting force to the coring tool. Remove the tool by pulling up on the handle while simultaneously applying a twisting force. If the sample was retrieved successfully, a plug of soil approximately two inches long should have been removed with the coring tool. If turf-like

vegetation (lawn), is present at the sample location, the sod will be cut and removed prior to advancing the coring tool. The coring tool will then be driven into the newly exposed soil to the measured 2 inch interval as marked on the outside of the auger.

Hold the soil coring tool horizontally or place it on the ground. Using a clean spatula or knife, remove the soil collected at depth greater than two inches from the end of the sampling tool. Excess soil material will be replaced at the sampling point. Use a trowel to extrude the soil from the auger, pushing the two-inch soil plug from the coring tool so that it falls directly into the stainless steel compositing bowl. If sod-material was removed, scrape the loose soil from the turf plug and allow to it to fall into the compositing bowl. Repeat the steps outlined above until all of the sub-samples for a composite have been collected and homogenized in the compositing bowl. After homogenization, the sample will be transferred to a large zip-lock bag. Repeat the steps outlined above for collection of the second and third composite samples.

Further sample preparation homogenization will be performed in accord with the Sample Preparation SOP #MK-VBI70-05.

If sampling equipment is to be re-used, follow the decon procedures outlined in Section 9.0 before collecting the next composite sample.

6.0 SAMPLE CONTAINERS AND LABELING

Following the procedures outlined in Section 5.0, grab samples will be composited and then placed into sample containers (quart-sized plastic ziplock bags or larger). For each composite sample, three sample identification labels are required. One label is placed on the Soil Collection Data Sheet (Attachment 1), one label is affixed to the quart-size bag containing the sample, and one label remains loose in the gallon-sized (or larger) ziplock bag which are reserved for sample preparation.

Sample labeling will occur as prescribed below:

1) Place a pre-printed label ending with the "-R" onto the composite sample (See Sample Identification and Tracking SOP# ISSI-VBI70-01).
2) Place a pre-printed label ending with the "-R" onto the Soil Data Collection Sheet.
3) Place a third pre-printed sample label ending with the "-B" designation onto another quart-sized zip-lock bag. There will be no sample in this bag, but it will be brought back to the field office unfilled and will serve as the sample container for the prepared sample sieved to <2 mm (bulk fraction).
4) This procedure will be repeated for the second and third composite samples collected at a property using clean zip-lock bags and unique sample ID numbers.
5) Place the 3 samples into a larger (gallon size) zip-lock bag that has been marked on the outside of the bag with the property address with permanent marker.

A percentage of samples will be selected for fine fraction (<250 um) analysis, as described in the Project Plan. Selected samples will be prepared in accord with the sample preparation SOP (No. MK-VBI70-05), and labeled with an "-F" designation written in permanent marker on the sample identification label.

7.0 SITE CLEAN-UP

Each hole made in the yard using the auger must be backfilled with clean topsoil and tamped down lightly. If sod was removed to obtain the soil sample, the hole should first be backfilled and then the grass plug be replaced by the field personnel.

If any rinse water used for sample decontamination is generated in the course of sample collection, it must be disposed of as specified in the SOP for Investigation Derived Waste Management (MK-VBI70-04). Wherever possible, sod and soil (not collected and retained as part of the composite sample) should be replaced in the same hole.

All flags (if reused) should be decontaminated by wiping off with towels and/or baby wipes before re-use.

Throw all used wipes and gloves into the trash bags and take with you to dispose of at the field office.

8.0 RECORD KEEPING AND QUALITY CONTROL

Each field crew will carry a three-ring binder book that contains the surface soil data sheet, site diagram, and sample labels. In addition, a field notebook should be maintained by each individual or team that is collecting samples, as described in the Project Plan. At the end of each day, the field crews will submit the site sketches and data sheets to the FPL. Each sampled property must have site sketches with sub areas and grab sample locations needed for the sub-samples, as described in Section 4.1. Deviations from this sampling plan should be noted in the field notebook, as necessary.

For each property, the notebook information must include:

a. date
b. time
c. personnel
d. weather conditions
e. sample identification numbers that were used
f. locations of any samples and sub-samples that could not be collected

g. descriptions of any deviations to the Project Plan and the reason for the deviation.

Samples taken from soils with visible staining or other indications of non-homogeneous conditions should also be noted. Field personnel will collect the proper type and quantity of quality control samples as prescribed in the Project Plan.

9.0 DECONTAMINATION

Because decontamination procedures are time consuming, having a quantity of sampling tools sufficient to require decontamination at a maximum of once per day is recommended. All sampling equipment must be decontaminated prior to reuse as prescribed in the Decontamination SOP (#MK-VBI70-07).

10.0 GLOSSARY

Project Plan - A written document that spells out the detailed site-specific procedures to be followed by the FPL and the field personnel.

Sample Point - The actual location at which the sample is taken. The dimensions of a sample Point are 2" in diameter and 2" deep (core technique) or 2" across by 2" deep (spoon/scoop technique).

Composite Sampling - A sample program in which multiple sub-sample points are compiled together and submitted for analysis as a single sample.

Sample zone - A unit of surface area subjected to a given sample program. A given zone usually is thought to contain similar metals concentrations or to be defined by a single set of exposure parameters.

11.0 REFERENCES

USEPA, 1995. Residential Sampling for Lead: Protocols for Dust and Soil Sampling, Final Report, EPA 747-R-95-001, USEPA, March 1995, 38 p.

American Society for Testing and Materials, 1995. Standard Practice for Field Collection of Soil Samples for Lead Determination by Atomic Spectrometery Techniques, ASTM Designation: E 1727 - 95, October 1995, 3 p.

Surface Soil Data Sheet

Phase: 3

Medium: Surface Soil

SOP: ISSI-VBI70-02 Rev. 2

Depth: 0-2"

Date: ____/____/____

Sample Team ID: _____

Location: _____ (House #) _____ (Street Name)

Building Type: Residential (circle one): Single Multifamily Apartment

School (name): _____

Park (name): _____

Class: FS

	Sample Number:	**Sample Time:**	**Sample Type:**
1st			COMP GRAB
2nd			COMP GRAB
3rd			COMP GRAB

Vegetable Garden Present? Yes No

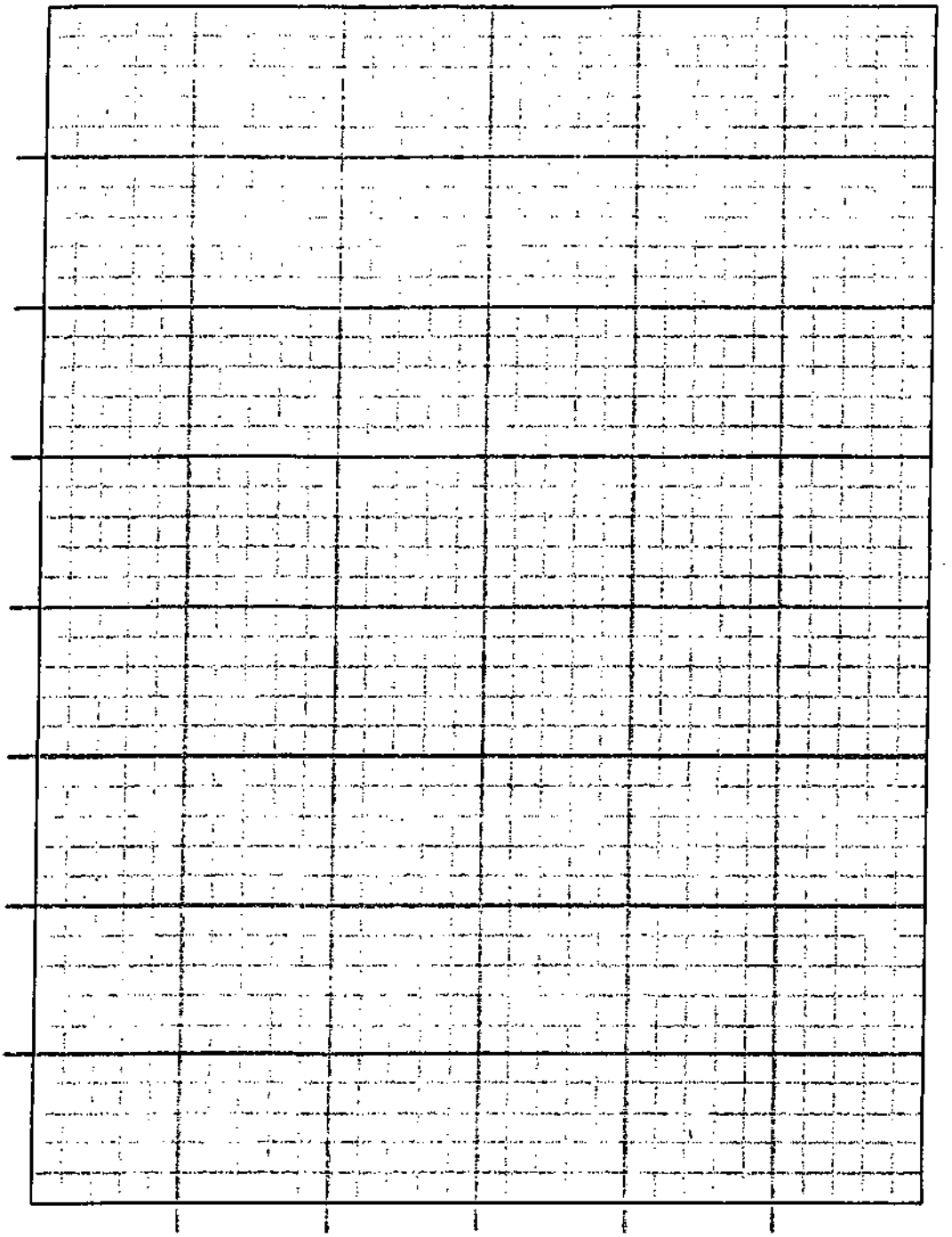
Address Confirmed by Resident? Yes No

Willing to Allow Further Sampling? Yes No

Notes:

FIELD DIAGRAM

North Arrow



Sub Area	No. of Grids	Grid Area per Flag (APF)	No. of Flags in Sub Area (SubArea Grids ÷ APF)
1			
2			
3			
4		(Total Grids ÷ 30)	
5			
6			
7			
8			
Total Grids:			Total Flags (30):

Signature *Date*

Samples Collected By: _____

Data Sheet Reviewed By:

Figure 1 Proposed Grid Sampling Design for Residential Surface Soil

Step 1:

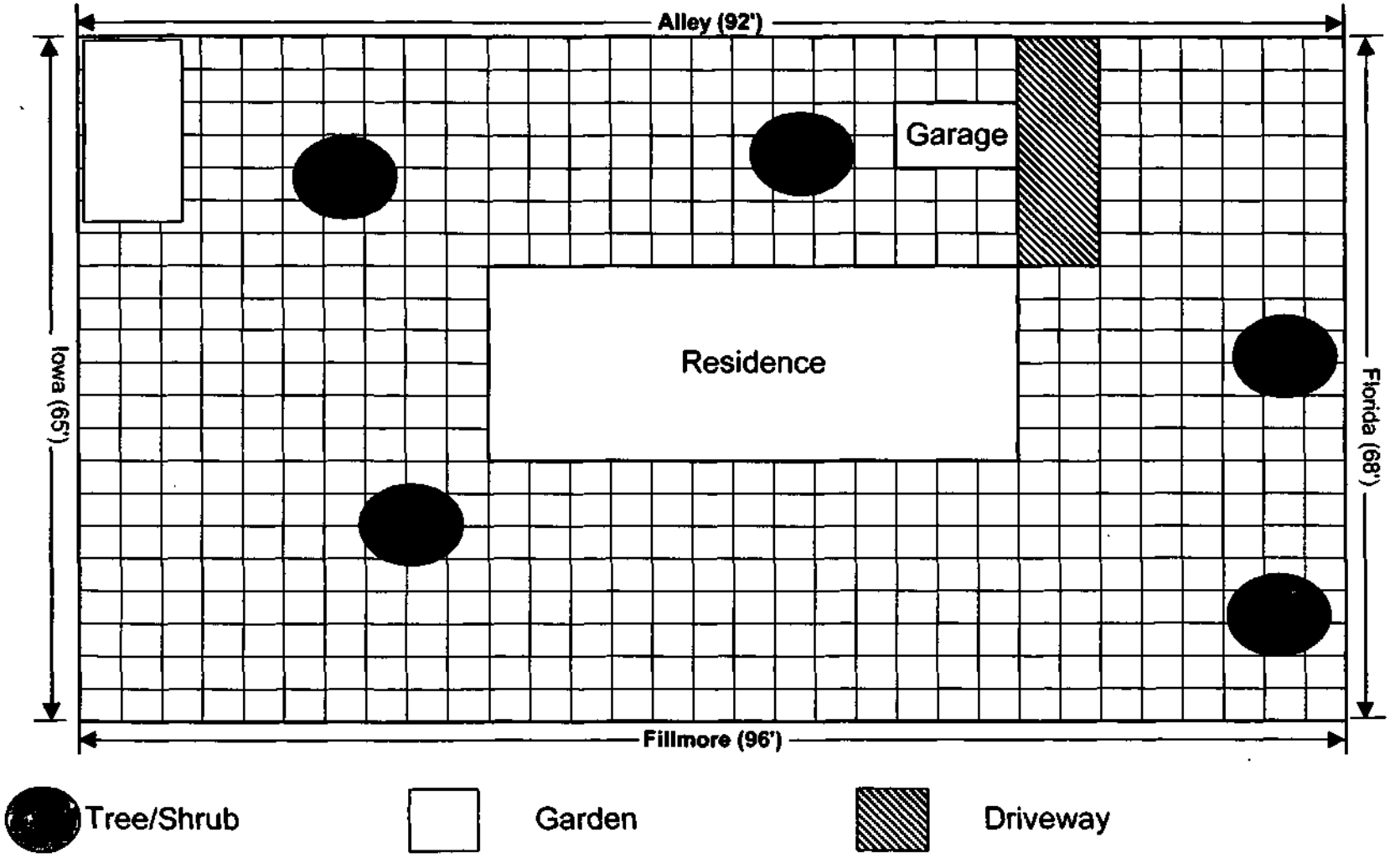
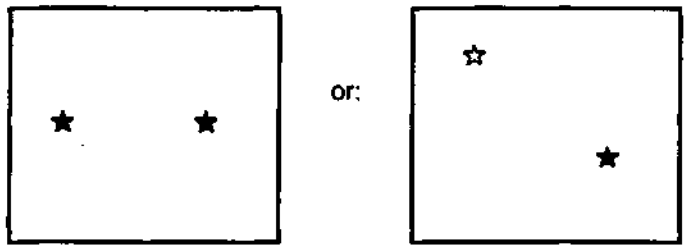


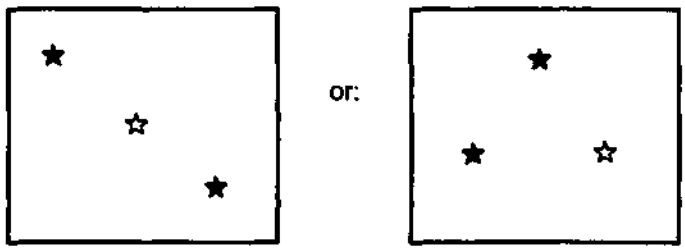
Figure 2

Idealized Sample Point Locations for Different-Sized Sample Areas

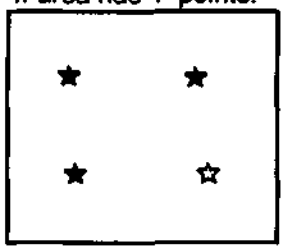
If area has 2 points:



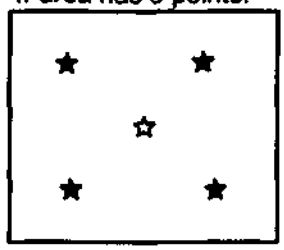
If area has 3 points:



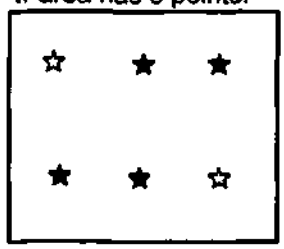
If area has 4 points:



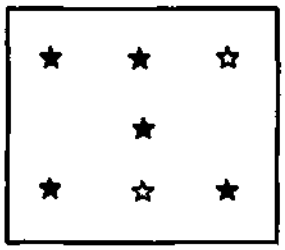
If area has 5 points:



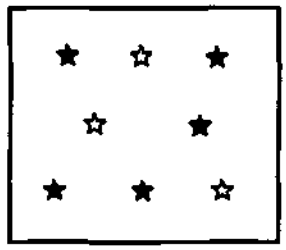
If area has 6 points:



If area has 7 points:



If area has 8 points:



If area has 9 points:

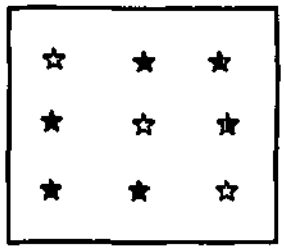
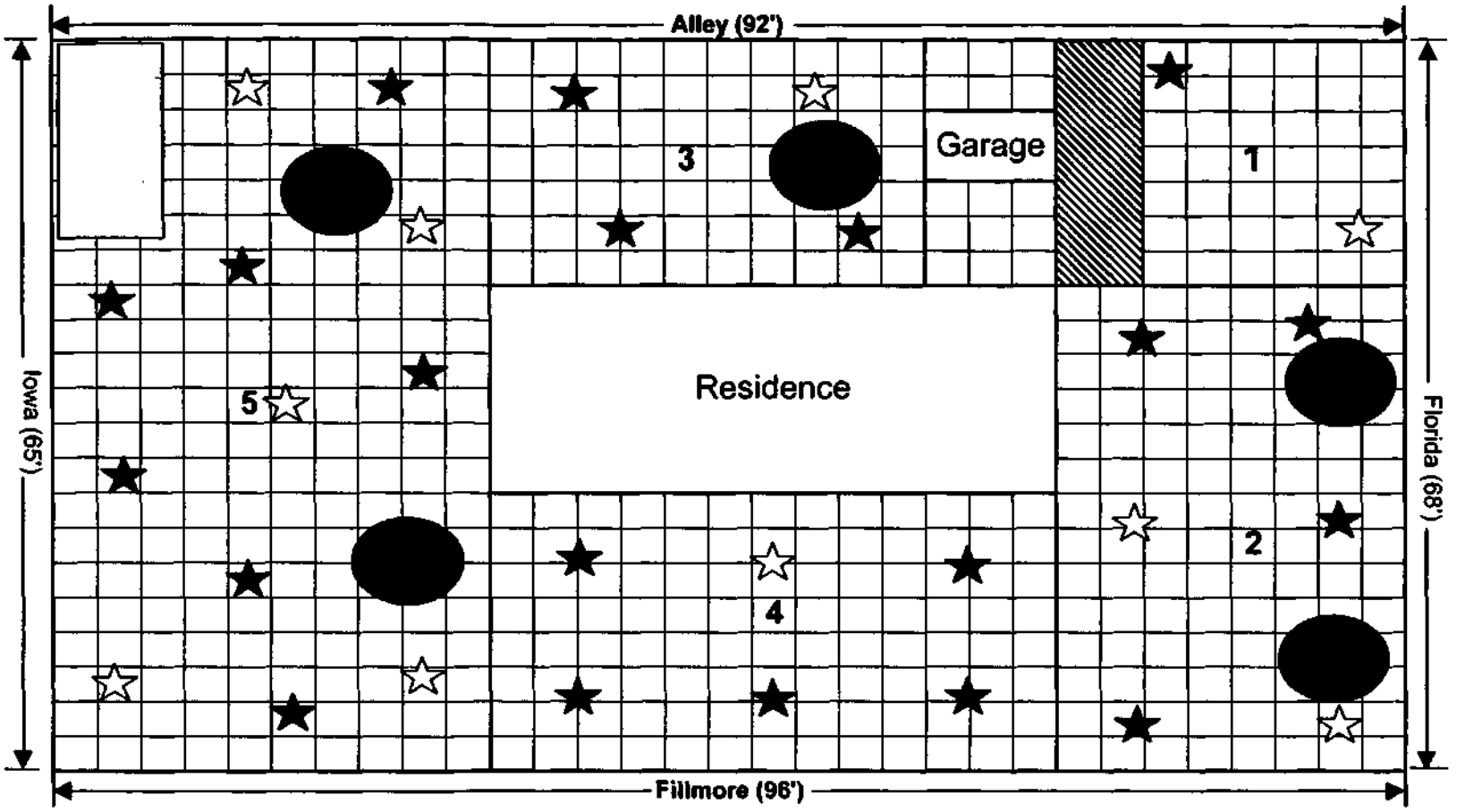


Figure 3 Proposed Grid Sampling Design for Residential Surface Soil

Step 2:



Tree/Shrub

Garden

Driveway/Sidewalk

Sampling Locations

Sub Area	No. of Grids	No. of Flags
1	42	2
2	112	6
3	70	4
4	104	6
5	210	12
Total:	**538**	**Total: 30**

Divide by 30: 17.93

smlgridyard